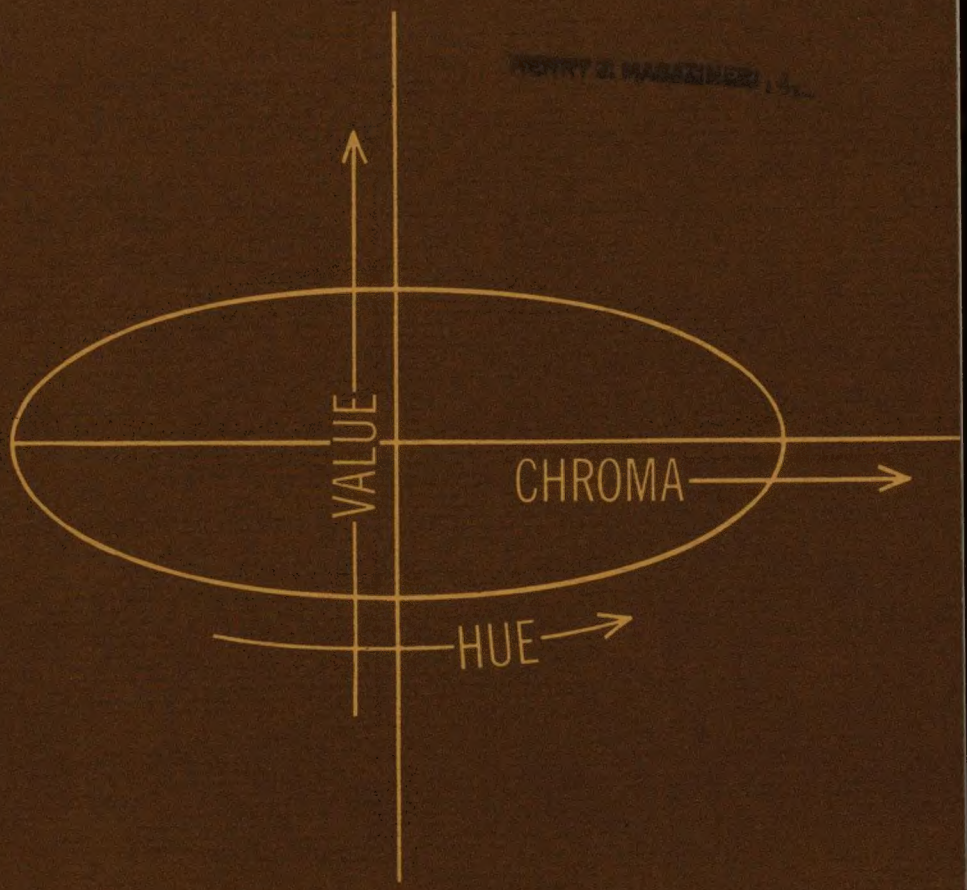
MUNSELL



Color: NOTATION • STANDARDS • EQUIPMENT
TECHNICAL SERVICES

MUNSELL SYSTEM OF COLOR NOTATION

The system of color notation, developed by A. H. Munsell, identifies color in terms of three attributes: **hue, value and chroma.** This method of color notation arranges the three attributes of color into orderly scales of equal visual steps; the scales are used as dimensions or parameters for accurately analyzing and describing color under standard conditions of illuminating and viewing.

The **hue notation** of a color indicates *its relation to a visually equally spaced scale of 100 hues.* There are *10 major hues* (5 principal and 5 intermediate) positioned ten hue steps apart within this scale. The hue notation in general use is based on the ten major hue names: **Red,** Yellow-Red, **Yellow,** Green-Yellow, **Green,** Blue-Green, **Blue,** Purple-Blue, **Purple** and Red-Purple.

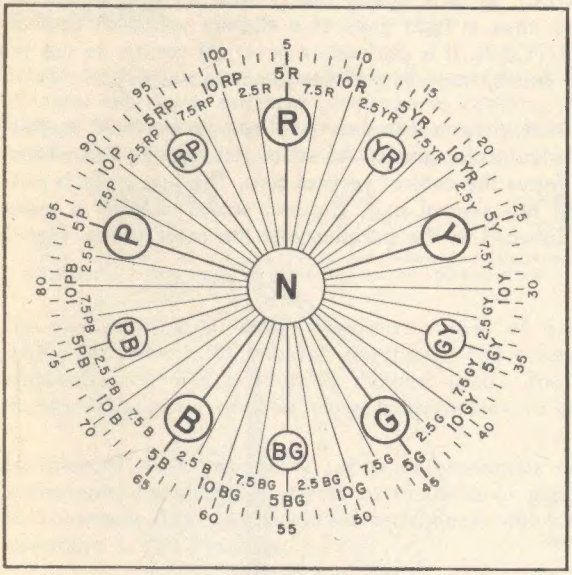


Figure 1

Related hue symbols arranged on 100 hue circuit

Any one of several symbols may be used for the notation of hue, as shown in Figure 1. Hue initials for the ten major hue families, shown in the inner circle, may be used alone for rough identification of hue. Numerals from 1 to 100, as shown in the outer circle, may be used alone for statistical records, cataloging and computer programming. The *combination of numerals with the hue initials* is considered the most descriptive form of the hue notation. This combination is shown between the inner and outer circles in Figure 1, and this is the form used on the 40 constant hue charts displayed in the *Munsell Book of Color.*

The **value notation** indicates the *degree of lightness or darkness* of a color in relation to a neutral gray scale, which extends from absolute black to absolute white. The value symbol 0/ is used for absolute black; the symbol 10/ is used for absolute white. The symbol 5/ is used for the *middle gray* and for *all chromatic* colors that appear half-way in value between absolute black and absolute white. Figs. 2 and 3.

The **chroma notation** indicates the *degree of departure of a given hue* from a *neutral gray* of the same value. The scales of chroma extend from /0 for a neutral gray out to /10, /12, /14, or farther, depending upon the strength (saturation) of the sample to be evaluated. A color classified popularly as "vermilion" might have a chroma as strong as /12 (or as vivid as /16), while another color of the same hue and value, classified popularly as "rose", might have a chroma as weak (grayed) as /4. Figs. 2 and 3.

The **complete** Munsell notation for a *chromatic* color is written symbolically: H V/C. The complete notation for a sample of "vermilion" might be 5R 5/14, while the notation for a sample of "rose" might be 5R 5/4.

When a finer division is needed for any of the attributes, decimals are used; for example: 2.8R 4.5/12.4.

The notation for a **neutral** (*achromatic*) color is written: N V/. The notation for a sample of "black", a very dark neutral, might be N 1/; the notation for a sample of "white", a very light neutral, might be N 9/, while the notation for a "gray" visually half-way between these two would be N 5/. The chroma symbol /0 may be used in the notation for neutral colors but it is customary to omit it. Blacks, grays and whites of chroma weaker than /0.3 are customarily notated as neutrals; if a more precise notation is required, the form used is: N V/(H,C). In such cases, the symbol for one of the ten major hues is used with the chroma; thus, a light gray of a slightly yellowish appearance might have a notation of N 8/(Y,0.2). It is perfectly correct, of course, to use the regular H V/C form to describe all colors, using N V/0 for absolute neutrals.

The Munsell scales of hue, value and chroma can be visualized in terms of a color solid, or color space. The neutral value scale, graded in equal visual steps, from black at the bottom to white at the top, forms the central vertical axis. The hue scale is positioned in equal visual steps around the neutral axis. Chroma scales radiate in equal visual steps from the neutral axis outward to the periphery of the color space. Figs. 2 and 3.

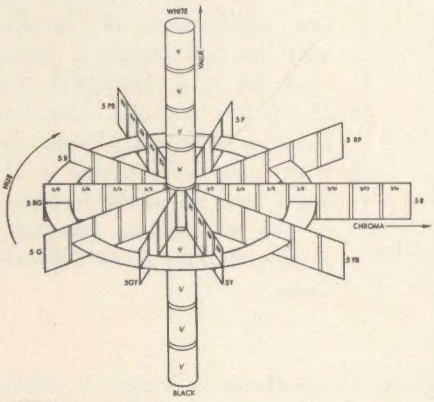


Figure 2

Hue, value and chroma scales arranged in color space

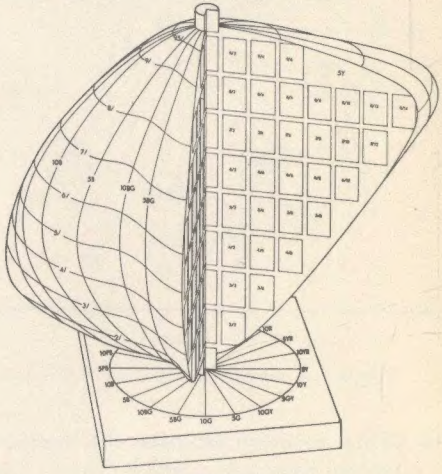


Figure 3

Munsell color solid with one quarter removed to show constant hue 5Y

The scales shown in Figures 1, 2 and 3 are intended to illustrate the concept of three dimensional color space; they are not limited to the notations shown. Each scale, by the use of decimals, may be divided into increments as small as may be required for the most accurate color notation. The chroma scales may be extended to include the chroma notation of all material samples. The value scale is limited by the end points (absolute black and absolute white); these are not achievable in material form. The hue scale forms a closed circle.

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MUNSELL COLOR STANDARDS—DEVELOPMENT AND CURRENT STATUS

The first complete *Munsell Atlas of Color,* published in 1915, displayed color scales which represented the development of Munsell color space up to that time. Subsequent studies at the National Bureau of Standards, and in the Munsell laboratory, resulted in the improved scales published in the 1929 editions of the *Munsell Book of Color.*[1]

In 1943, a Subcommittee of the Optical Society of America on the Spacing of Munsell Colors[2] reported the characteristics of a modified color space. Color scales produced to represent the recommended changes in the spacing are considered to approach more closely A. H. Munsell's ideal for equal visual steps. The revised spacing is defined in terms of the CIE (International Commission on Illumination) standard observer and coordinate system for color specification. The Munsell-CIE correlation affords a method for converting instrumental measurement data to Munsell *renotation* and provides the first definite psychophysical specification for production of Munsell color standards.

Except for certain limit colors along the outside of the gamut of the current collections, all color standards are now produced to conform to the renotation specification within Munsell AAA tolerance. The exceptions are published on lists of notations of Munsell standards carried in stock. The AAA tolerance is defined as follows:

TOLERANCE	HUE	VALUE	CHROMA
AAA	± 2/C*	± 0.05/	± /0.20

* Hue tolerance at chroma /1 is *two whole* hue steps on the 100 hue scale. Hue tolerance at chroma /10 is *two tenths of a hue step* on the 100 hue scale.

The present Munsell color standards consist of opaque lacquer films on cast-coated paper for over 1,500 Munsell notations. The colorants employed are the most stable obtainable for the production method used. The lacquer-coated papers are called standards because of their close conformance to the renotation specification.

Samples of each production of color standards are subjected to spectrophotometric measurement and visual checks at the time of production and periodically thereafter. Measurement data are provided on request with orders for color standards, as noted elsewhere in this brochure.

It is estimated that, under usual industrial color-matching conditions, the human eye can perceive several million different colors. No set of material color standards can sample the color space extensively enough to provide a match to every possible color. However, the visual spacing and decimal system of notation of the Munsell scales permit all colors to be given notations by reference to the available material standards. More accurate notations for color samples that do not exactly match one of the standards can be determined from instrumental measurements.

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[1] D. Nickerson, *J. Opt. Soc. Am.*, Vol. **30**, No. 12, p. 575 (1940).
[2] Newhall, Nickerson & Judd, *J. Opt. Soc. Am.*, Vol. **33**, No. 7, p. 385 (1943).

APPLICATIONS OF MUNSELL SYSTEM AND PRODUCTS

The Munsell notation system is useful wherever color communication and specification are necessary. The equally spaced color scales provide a convenient tool for expressing the perceived color of an object and the color differences observed among a group of objects. The notation is universally used in research studies on the physics and psychology of color.

Many government and industrial color specifications are written in terms of Munsell notation. The USA Standards Institute[1] and the American Society for Testing and Materials[2] have incorporated the Munsell notation in their standards. The Inter-Society Color Council and the National Bureau of Standards use the notation to specify color-name limits in *ISCC-NBS Method of Designating Color*. The *Japanese Industrial Standard for Color* is based on the Munsell notation. The British Standards Institute uses the notation to designate standard paint colors. The *German Standard Color System* (DIN 6164) provides a Munsell notation for each of its 585 samples.

The simplicity and flexibility of the Munsell system allow for countless applications. The development and specification of color designs and the communication of color information between sales, engineering and production departments are facilitated by reference to Munsell notations and color standards. Custom-made Color Tolerance Sets provide a convenient visual standard for color quality control.

Abridged collections of Munsell color standards meet specific requirements in a variety of fields. The Plant Tissue Color Collection and Soil Color Charts are used by agronomists, biologists, archaeologists, geologists and other scientists to record the color of specimens. Neutral Density Cards, the Chart Photometer and Neutral Value Scales are among the Munsell products particularly useful in television, photography, microfilming and illuminating engineering. Several collections are designed for color grading of raw or processed foods and other agricultural products. Other collections meet color coding specifications for safety colors, electronic components and wire insulation.

Disk colorimetry is a simple, accurate method for matching, grading and specifying the color of many agricultural and industrial products. The color of any item within the range of Munsell standards can be matched by a proper selection of Munsell disks. Disk colorimetry is also used in psychological color studies and in color education.

Munsell educational materials emphasize the concepts of color appearance and relationships as taught in psychology, home economics, art and design. Munsell Student Sets and Consumer Color Charts provide teachers and students with tools for both classroom demonstrations and workshops as well as permanent reference materials.

The Farnsworth-Munsell 100 Hue Test is a dual-purpose test which examines subjects for color vision anomalies (color blindness) and at the same time grades color normals on their color aptitude. Other Munsell color vision materials test color memory and for complete absence of color vision.

Custom color standards are produced to order for requirements not met by stock items. If you have a specific color problem not covered herein, please write us for additional information and assistance.

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[1] USASI Standard Z58.7.3
[2] ASTM Standard D 1535

MUNSELL

CATALOG OF PRINCIPAL PRODUCTS AND TECHNICAL SERVICES

NOVEMBER, 1969

CATALOG REFERENCE NUMBERS ARE KEYED
TO ENCLOSED PRICE SCHEDULE

Catalog Reference

MUNSELL BOOK OF COLOR is offered in two collections.

GLOSSY FINISH COLLECTION displays 1,450 color chips *inserted in slots* on charts for 40 neighboring hues (2.5R-10RP) arranged on facing pages; 18-step neutral value scale shown on 2.5R hue chart. *Each color chip may be removed from chart* for comparison to specimen to be identified. Chart size: 10″ × 12″; chip size: 11/16″ × 13/16″; **two** loose-leaf binders, size: 13″ × 12″ × 2″ each. Furnished with instructions and masks.
(Order "Glossy *Book of Color*") ..... *Complete* 6–1

Supplementary Set of 83 Strong Chroma Glossy Color Chips consists of 22 hues between the regular 40 hues, where /12 chroma or stronger is achievable. Color chips may be positioned in extra slots provided in the 40 hue charts ..... *Set of 83 Chips* 6–2

Hue Chart (From glossy collection, specify hue) ..... *One Chart* 6–3

Color Chip (From glossy collection, specify notation) .....
One 11/16″ × 13/16″ Color Chip 6–4

MATTE FINISH COLLECTION displays 1,146 color chips *permanently mounted* on charts for 40 neighboring hues (2.5R-10RP) arranged on facing pages; 9-step neutral value scale shown on alternate charts; supplementary chart displays 8.5/ value chips for hues 10YR-10GY. Charts, in clear plastic protective envelopes, may be removed for comparison to specimen to be identified. Chart size: 8½″ × 11″; chip size: ⅝″ × ⅞″; **one** loose-leaf binder, size: 11½″ × 9½″ × 1¾″. Furnished with instructions and masks.
(Order "Matte *Book of Color*") ..... *Complete* 6–5

Hue Chart (From matte collection, specify hue) ..... *One Chart* 6–6

8.5/ Value Chart (From matte collection) ..... *One Chart* 6–7

Color Chip (From matte collection, specify notation) .....
One ⅝″ × ⅞″ Color Chip 6–8

Renotation Data for Current Matte Book of Color: Production number and renotation from current spectrophotometric measurement data for CIE Illuminant "C". *Booklet, 8½″ × 11″ pages, plastic binder* 6–9

Dominant Wavelength and Excitation Purity computed from renotation specification data for CIE Illuminant "C". Contains dwl and P_e for all colors displayed in current editions of the *Book of Color* both glossy and matte.
Booklet, 8½″ × 11″ pages, plastic binder 6–10

Catalog Reference

MUNSELL COLOR FILE is offered in two collections.

GLOSSY FINISH COLLECTION consists of 1,450 color swatches; includes 18 neutrals and value/chroma variations for 40 hues with Munsell notations printed below each on white backing tab. Swatches are indexed in hue order, in plastic laminated box with hinged lid and handle. Color swatch size: 1 5/16″ × 1 5/8″; box size: 10 1/2″ × 8″ × 4″. Furnished with instructions and masks. (Order "Glossy Color File") ..... *Complete* 7–1

Supplementary Set of 83 Strong Chroma Color Swatches consists of 22 hues between the regular 40 hues, where /12 chroma or stronger is achievable. May be inserted in appropriate hue order in *Color File* .. *Set of 83 Swatches* 7–2

Color Swatch (From glossy collection, specify notation) ..... *One 1 5/16″ × 1 5/8″ Color Swatch* 7–3

MATTE FINISH COLLECTION consists of 1,153 color swatches; includes 16 neutrals and value/chroma variations for 40 hues with Munsell notations marked on back of each. Color swatches are indexed in hue order in gray steel box with hinged lid. Color swatch size: 1 1/2″ × 3″; box size: 5 3/4″ × 4″ × 3 1/2″. Furnished with instructions and masks.
(Order "Matte Color File") ..... *Complete* 7–4

Color Swatch (From matte collection, specify notation) ..... *One 1 1/2″ × 3″ Color Swatch* 7–5

INDIVIDUAL COLOR STANDARDS are offered in sizes other than those contained in Books and Files. Notations are recorded on back of each. Prices listed are for a single notation in one or the other finish. Please specify *size, notation* and *finish* required on orders for individual color standards.

Matte Finish	Glossy Finish		
8 1/2″ × 11″	6″ × 10″	*One Sheet*	7–6
3″ × 5″	3″ × 5″	*One Swatch*	7–7

Discounts quoted, upon request, on lots of 50 or more papers in stock sizes.

Copies of Spectrophotometric Curves of Munsell Color Standards, including CIE data and Munsell renotation ..... *Each Curve* 7–8

CIE Tristimulus Data and Munsell Renotations derived from them will be provided upon request with orders for standard size 3″ × 5″ or larger. A fee is charged for data on smaller size standards ..... *Per Notation* 7–9

Catalog Reference

USASI SAFETY COLOR STANDARDS represent the central notation (centroid) of color regions specified in USA Standard Z53.1-1967 for marking hazards and identifying certain equipment. Glossy color standards, 3″ × 5″, are provided for 8 regions: red, orange, yellow, green, blue, purple, black and white. ..... USAS Z53.1-1967 *Set of 8 Standards* 8–1

ISCC–NBS CENTROID COLOR STANDARDS represent the central color notation of each color-name block (region) specified in the "ISCC–NBS Method of Designating Color and a Dictionary of Color Names." Set consists of 251 glossy color standards, 9″ × 12″, (all that are achievable of 267 specified). Furnished with copy of *ISCC–NBS Centroid Color Charts (NBS Standard Sample #2106)* which display 1″ squares of centroid in each color-name block ..... *Set of 251 Standards* 8–2

Large Centroid Color Standard, 9″ × 12″ (Specify ISCC–NBS Color Name and Block Number) ..... *One 9″ × 12″ Standard* 8–3

MUNSELL COLOR CHARTS FOR COLOR CODING. This is the Third Edition of our charts which have been used for many years by the Bell System, REA and many other government agencies for color coding of wire and cable insulation. This edition has been adopted by Electronics Industries Assn. (STD. RS-359) for use with electronics components. Color regions are specified for ten color names: Red, Orange, Brown, Yellow, Green, Blue, Violet (Purple), White, Gray (Slate), and Black. There is a separate chart for each name. Each chart defines and illustrates the Centroid (ideal) color for that name and the permissible color tolerances around it. Chips are high gloss and are permanently mounted on chart 8½″ × 11″. Instructions on each chart. Includes 3″ × 5″ swatch of each Centroid. Loose-leaf binder. *Set of 10 Charts* 8–4

Single Chart (specify Color Coding and Color Name) 8–5

Centroid Color Standards, 3″ × 5″, (set of 10) 8–6

NEUTRAL DENSITY TEST CARDS for use in complying with government microfilming specifications, consist of glossy color cards, 6″ × 6″, with reflectances of 6%, 25% or 50%. Specify the reflectance, or reflectances, required.

Quantity

1 to 99 ..... *Each Card* 8–7

100 to 199 ..... *Each Card* 8–8

200 or more ..... *Each Card* 8–9

SOIL COLOR CHARTS (Ref. 10-6). Used to classify color of soils, pottery and similar materials. Apertures allow direct comparison of samples to standards; color name found from diagram.

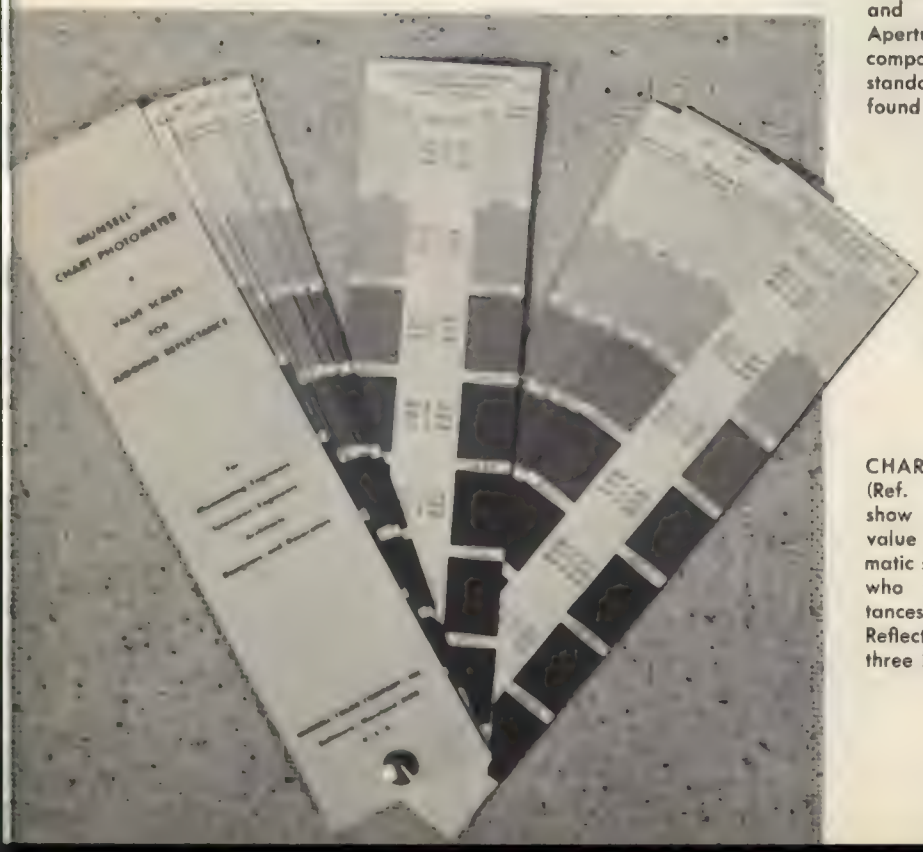
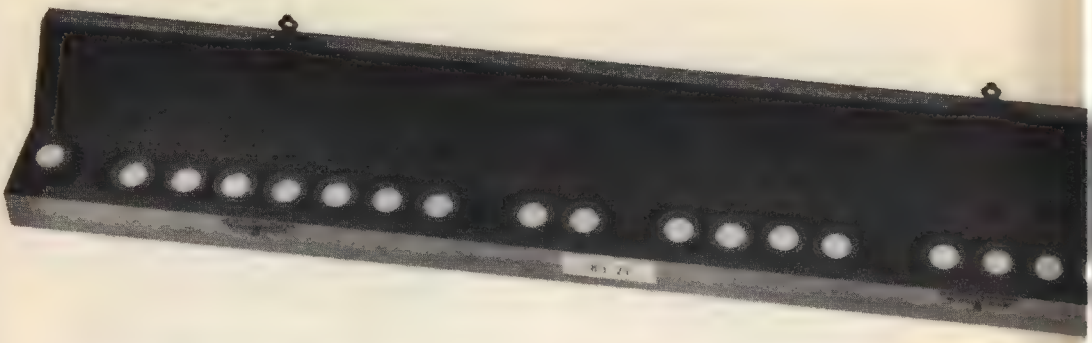
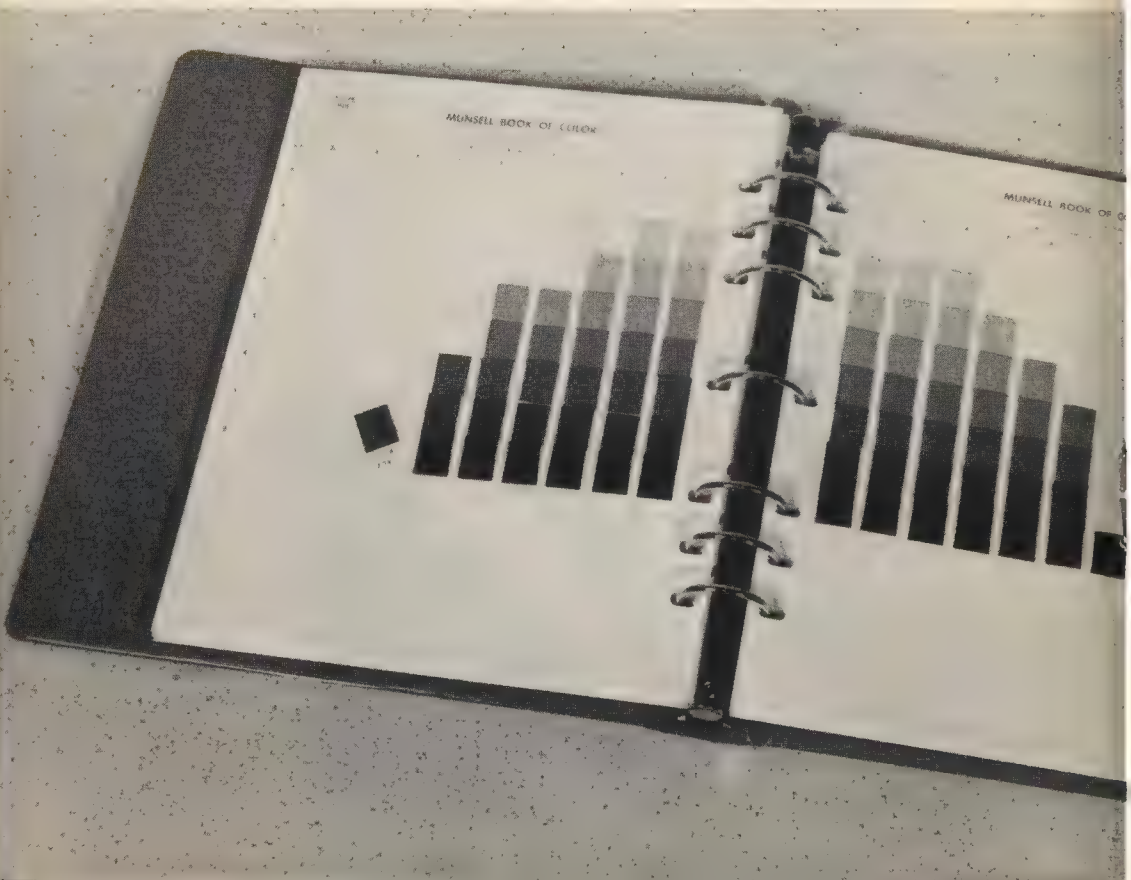


CHART PHOTOMETER (Ref. 9-1). Spread to show portions of neutral value scale and 10 chromatic scales. Useful to all who work with reflectances and illumination. Reflectances given for three light sources.

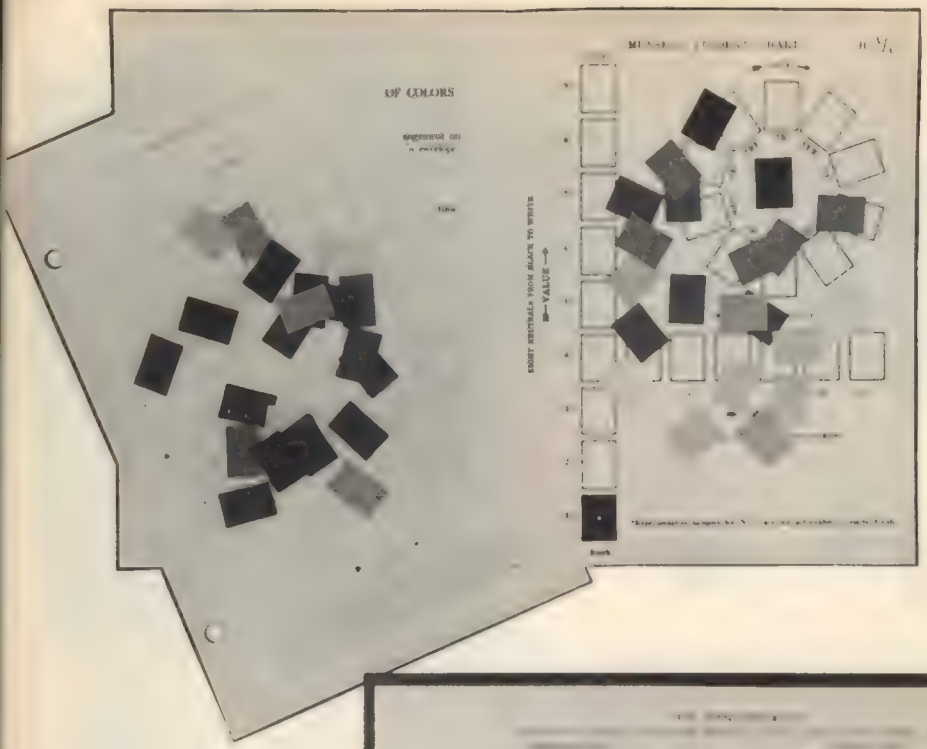


FARNSWORTH-MUNSELL 100 HUE TEST (Ref. 14-1) for color vision anomalies and color aptitude. One tray with several color caps removed is shown. Person being tested arranges colors in proper visual order. Complete test contains four trays in carrying case, instructions and score sheets.

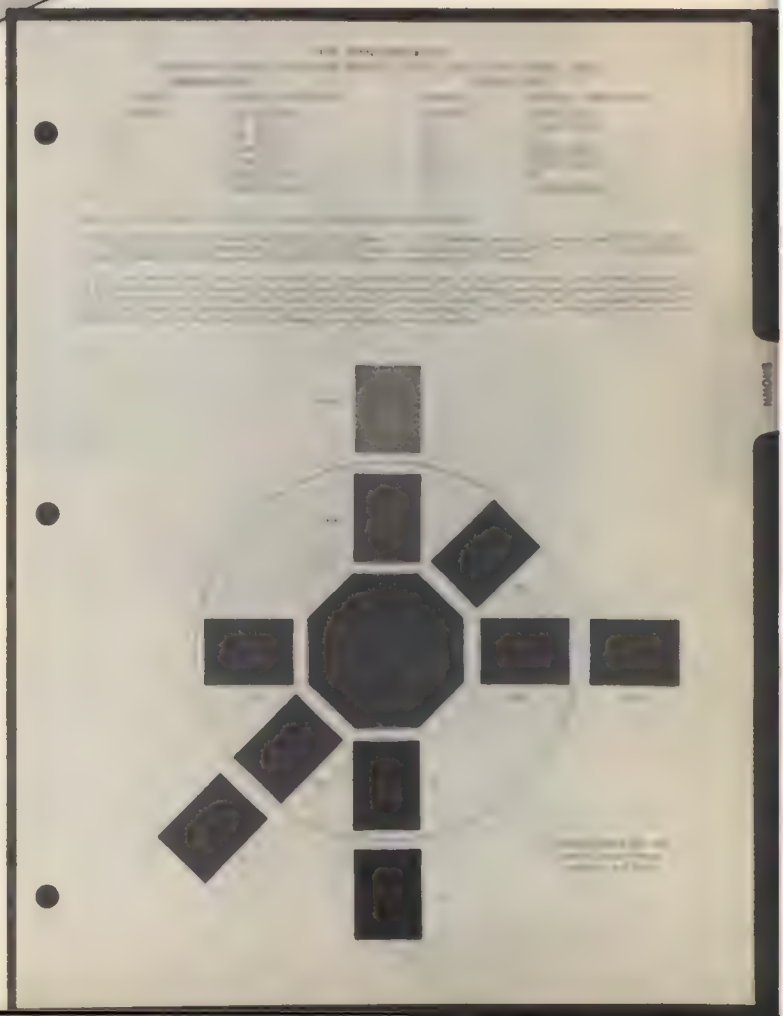


MUNSELL COLOR FILE contains basic collection of Munsell color standards filed by hue. Glossy Color File (Ref. 7-1) is illustrated. Loose swatches show backing tab with printed notation. Laminated file box has room for additional colors or customer's samples. MUNSELL COLOR FILE is also available with matte finish swatches (Ref. 7-4).

MUNSELL BOOK OF COLOR displays basic collection of Munsell color standards on 40 constant hue charts. Glossy Finish Collection (Ref. 6-1) contains removable chips in two binders. One volume is shown open at charts for adjacent hues of 7.5PB and 10PB. The MUNSELL BOOK OF COLOR is also available in Matte Finish Collection (Ref. 6-5) with permanently mounted chips in a single binder.



STUDENT SET charts (Ref. 12-2 and 12-3). Each set contains one H V/C chart, one or more constant hue charts and *A Color Notation*. Student arranges and mounts chips in proper order.



COLOR CODING charts (Ref. 8-4). Used for wire and cable insulation, electronic components. A chart for each of the 10 colors shows ideal color (centroid) plus permissible deviations.

Catalog Reference

CHART PHOTOMETER Value–Reflectance Scales developed with IES for use by lighting and television engineers, architects, and designers for all fields where illumination is an important consideration. This item provides a tool for determining the degree of change in reflectance that may be expected for a color sample with change in light source; displays 156 matte color chips permanently mounted on edges of 11 charts: one 16-step *neutral* value scale, and *chromatic* value scales for *10 major hues* (5R – 5RP), at low and maximum chromas on 3/ – 9/ value levels. Percent reflectance, computed from spectrophotometric measurements of standard, for CIE Light Sources "A," "C" and "S," are printed adjacent to the chips on each scale. Chart size: 2" × 8⅜"; chip size: ⅝" × ⅞". Furnished with instructions and masks in soft vinyl case ..... *Set of 11 Charts* 9–1

NEUTRAL VALUE SCALES available in either *matte* or *glossy* finish color chips. Both scales display chips between absolute black and absolute white, at 0.5/ value step intervals, permanently mounted on edges of white charts; matte scale displays 16 steps, ranging from 2.0/ to 9.5/ value; glossy scale displays 19 steps, ranging from 0.5/ to 9.5/ value. Munsell notation and percent reflectance for daylight (CIE Light Source "C") are printed adjacent to the chips on each scale. Matte chip scale folds to size: 2⅜" × 7¼"; glossy chip scale folds to size: 2⅜" × 8¼". Chips on both scales are size: ⅝" × ⅞". Each scale is furnished with instructions and masks.

16-Step Scale of Neutral Matte Chips ..... *One Scale* 9–2

19-Step Scale of Neutral Glossy Chips ..... *One Scale* 9–3

Neutral Swatches, 3" × 5", at 0.5/ value intervals, as in above scales ..
Set of 16 Matte Swatches 9–4

Set of 19 Glossy Swatches 9–5

Neutral Swatches, 3" × 5", at 0.25/ value intervals .....
Set of 31 Matte Swatches 9–6

Set of 37 Glossy Swatches 9–7

Catalog Reference

BUTTER COLOR COMPARATOR designed by USDA inspectors for grading color of butter. Used also for margarine and other food products in this color range. Plastic sections of 5 typical butter colors are arranged on stainless steel stud threaded into stainless steel spatula. Size: 5⅛″ long × ½″ diameter. Furnished with instructions ..... *Complete* 10–1

RESAZURIN COLOR GRADER designed by USDA inspectors for grading bacterial content of milk. Consists of four matte color swatches, 5PB 7/4, 10PB 7/5.5, 5P 7/4 and 10P 7/8, arranged in test tube 5⅞″ long × ½″ diameter. Furnished with instructions ..... *Complete* 10–2

Resazurin Color Standards, 3″ × 5″, (Above notations) *Set of 4 Swatches* 10–3

PLANT TISSUE COLOR CHARTS provide a means for determining and recording color resulting from nutrient deficiency in plant tissues; 320 matte color chips are permanently mounted on charts for 17 hues: 2.5R, 5R, 10R, 2.5YR, 5YR, 7.5YR, 2.5Y, 5Y, 2.5GY, 5GY, 7.5GY, 2.5G, 5G, 7.5G, 5BG, 2.5B and 5RP. Chart size: 3¾″ × 6¾″; chip size: ½″ × ⅝″; loose-leaf binder: 7⅞″ × 4¾″ × 1″. Furnished with instructions and masks. . . *Set of 17 Charts* 10–4

Plant Chart (From above collection, specify hue) ..... *One Chart* 10–5

SOIL COLOR CHARTS developed with U.S. Soil Conservation Service for classifying the color of various soils. Used also in judging color of rocks, other archaeological specimens, animal pelage and many natural products in this color range; 190 matte color chips are permanently mounted on charts for basic collection of 7 hues (10R-5Y) with apertures between chips to facilitate observations. Chart size: 4¼″ × 7¼″; chip size: ½″ × ⅝″; loose-leaf binder: 7⅞″ × 5″ × 1″. Furnished with color-name diagrams, instructions and masks ..... *Set of 7 Charts* 10–6

Soil Chart (From above collection, specify hue) ..... *One Chart* 10–7

Supplementary Chart: 7.5R for tropical and semi-tropical soils, displays 23 color chips ..... *One Chart* 10–8

Supplementary Chart: 5R for Australia, Southeast Asia, etc., displays 29 color chips ..... *One Chart* 10–9

Supplementary Chart: Gley for submerged soils; displays 28 matte color chips; weak chromas and neutrals on value levels 4/-7/, for hues: 5Y, 5GY, 5G, 5BG & 5B ..... *One Chart* 10–10

Special Chart: Produced to order for additional hues, 7.5Y, 10Y, 2.5GY, etc. to 5B (Specify hue) ..... *One Hue Chart* 10–11

SKIN, HAIR AND EYE COLOR CHARTS recommended by leading anthropologists. Consist of 8 constant hue charts (5R-2.5Y) from *Soil Color Chart Collection* with one supplementary chart for a variety of eye colors other than the browns displayed on the constant hue charts. Charts display 280 color chips. Chart size: 4¼″ × 7¼″; chip size: ½″ × ⅝″; loose-leaf binder, size: 5″ × 7½″. Furnished with instructions and masks. ..... *Set of 9 Charts* 10–12

Catalog Reference

COLOR DISKS Maxwell-type, with radial slit to 1/4" diameter center perforation, available for each of the notations carried in stock in either matte or glossy finish. *Order for disks should specify notations, finish* and *size* required.

4" diam. Disk ..... *One Disk* 11–1

2½" diam. Disk ..... *One Disk* 11–2

Metal Forceps chamois-tipped for handling disks ..... *One Pair* 11–3

Calibrated Backing Disk for reading areas of exposed disks ..... *One* 11–4

MACBETH-MUNSELL DISK COLORIMETER provides two spinning disks, disk motors and sample holder for color matching under standard artificial lighting (CIE Illuminant C) and viewing conditions. Assembled to order. Write for specifications, price and delivery time.

DISK SPINNING MOTOR may be substituted for Macbeth-Munsell Disk Colorimeter when standardized illuminating and viewing conditions are on hand. Has variable speed (200–5,000 r.p.m.); 120v., 60cy., AC. Motor must be stopped to adjust disks. Size 7" × 6½" × 6". Furnished with calibrated backing disk ..... *One Motor* 11–5

DISK MIXTURE COMPUTATION FORM for converting disk mixture percentages to Munsell terms. Used with Munsell to CIE (x,y) diagrams. Size: 8½" × 11" ..... *Package of 100 Forms* 11–6

MUNSELL – CIE DIAGRAMS (1931) for converting CIE coordinates "x,y," to Munsell hue and chroma, or reverse. One diagram each for values 1/ – 9/, five additional diagrams on larger scale, for 5/ – 9/ value. Size: 22½" × 26¼". Furnished with sample computation form and a table for converting CIE "Y" to Munsell Value ..... *Set of 14 Diagrams* 11–7

CIE CHROMATICITY DIAGRAM (1931) with spectrum locus. For plotting data or determining dominant wavelength and purity from CIE coordinates "x,y". Size: 18" × 20" ..... *Package of 25 Diagrams* 11–8

MUNSELL – CIE DIAGRAMS (1960) for converting CIE coordinates "u,v" to Munsell hue and chroma, or reverse. One diagram each for values 1/ – 9/; large scale (18" × 26") photostat positives, printed to order. Delivery up to 30 days ..... *Set of 9 Diagrams* 11–9

CIE-UCS CHROMATICITY DIAGRAM (1960) with spectrum locus. For plotting data or determining dominant wavelength and purity from CIE coordinates "u, v". Green grid; size 31½" × 22" ..... *Package of 25 Diagrams* 11–10

Illumination is of prime importance for making accurate and reproducible color observations and should be specified. All significant color observations should be made under standard conditions of illuminating and viewing. Information concerning Macbeth light sources will be provided upon request.

Catalog Reference

A COLOR NOTATION by A. H. Munsell is widely used as a text book. It describes the principles of color order, color notation and color balance developed by the originator of the Munsell color system. Includes, as an insert, the H V/C chart described below, and a chapter on traditional color names. Size: 5¾″ × 8″; 67 pages, 11th ed., reprinted 1961 . . .*Hardback Copy* 12–1

STUDENT SETS are designed to teach Munsell color order and notation. Loose, unidentified, matte color samples are provided for the student to arrange in correct positions on the charts included with them. Each set contains a *paperback* copy of *A Color Notation*. Color samples in these sets are produced to broader tolerances than allowed for regular Munsell color standards. Chart size: 5⅜″ × 8⅜″; sample size: ½″ × ⅝″. Furnished with instructions.

11 CHART SET consists of constant hue charts for the 10 major hues (5R, 5YR, 5Y, 5GY, 5G, 5BG, 5B, 5PB, 5P and 5RP) and a copy of *A Color Notation*, with H V/C chart insert showing: 10-step hue circuit, 8-step gray scale and 6-step chroma scale; includes approximately 250 color samples. *Set of 11 Charts* 12–2

2 CHART SET includes one hue, selected from the 10 major hues of the 11-chart set and a copy of *A Color Notation* with H V/C chart insert described above . . . . . .*Set of 2 Charts* 12–3

Components from above sets

Student Chart with loose color samples: H V/C or constant hue. (Specify by title the chart or charts required) . . . . . .*One Chart* 12–4

A Color Notation by A. H. Munsell . . . . . .*Paperback Copy* 12–5

Additional items offered

Binder, black fabrikoid, three-ring . . . . . .*Each* 12–6

Envelope, clear plastic for protecting charts . . . . . .*Each* 12–7

Mounting Material Kit, glue, dauber, etc. . . . . .*One Kit* 12–8

Quantity discounts are offered on *A Color Notation* and *Student Sets:*
5 to 24: less 10%; 25 to 49: less 15%; 50 or more: less 20%

CONSUMER COLOR CHARTS are used by both teachers and students of home economics in learning the use of color in clothing, make-up and home furnishings. Widely used in homemakers clubs, college and high-school classrooms. Developed in cooperation with Extension Service. Single copies sent to instructors when requested on school letterhead. *Sold only in boxes of 50 sets.* 12–9

Catalog Reference

A GRAMMAR OF COLOR, based on the color system of A. H. Munsell, originally published in 1921, has been out-of-print for many years. A new edition of this classic, edited and up-dated by Faber Birren, includes most of the original material by Munsell and Cleland. Birren has added new chapters, with 8 color plates, in which he interprets Munsell's concept of color harmony and system of color notation. This book is recommended for amateur and professional artists, designers, decorators, teachers, students and all who work with color. Size 8¼″ × 8¼″, hardback cover, 96 pages, Van Nostrand Reinhold Co., 1969. 13–1

WALL CHART: enlarged H V/C chart displaying 10-step hue circuit, 8-step gray scale and 6-step red chroma scale. Matte samples, 3⅜″ × 2½″, are mounted on light gray chart, size 25″ × 38″ ..... *One Chart* 13–2

MUNSELL COLOR TREE illustrates the Munsell Color Solid. Matte color chips for 20 constant hues are permanently mounted on each side of clear plastic charts, which fit in clear plastic base, against center pole with top-lock. Plastic chart size: 6½″ × 8½″; base size: 8½″ diam.; pole size: 9½″ high; chip size: ⅝″ × ⅞″. This item is produced to order only; allow up to 90 days for delivery ..... *Complete* 13–3

COLOR SLIDES of 2 views of Color Tree and 1 each of vertical, horizontal and cylindrical planes through Color Tree, showing charts of constant hue (5Y and 5PB), constant value (5/) and constant chroma (/6). Size: 35mm. Glass mounts ..... *Set of 5 Slides* 13–4

COLOR SLIDES: Two slides show Hue, Value and Chroma scales (Figure 2 this booklet), one in black and white as illustrated, one in color; two color slides show opposite sides of color solid (Figure 3 this booklet without one quarter removed); one color slide represents vertical slice through the solid showing the opposite hues 5Y and 5PB flanking the neutral value scale. Size: 35mm. Glass mounts ..... *Set of 5 Slides* 13–5

DAVIDSON & HEMMENDINGER COLOR RULE is used for comparison of light sources or of observers. Consists of two painted sliding color scales of constant lightness. On one scale the steps blend in small increments from a purple to a green. On the second scale the steps blend in a similar series from blue to brown. A match between samples on the two scales is obtained by "slide-rule" adjustment of the scales. If two or more observers use the same light source, the comparison of their match points provides a means of testing the similarity of their color vision. The comparison of the match points of one observer using different light sources provides an indication of the similarity of the sources. *D & H Color Rule* 13–6

Catalog Reference

FARNSWORTH–MUNSELL 100 HUE TEST for determination of color vision anomalies and color aptitude. Consists of four trays, each containing a segment of 85 color reference disks mounted in recessed area of individual black plastic caps. Color vision anomalies and color aptitude are detected by the ability of testee to place color caps in hue order. Score sheet yields numerical and graphical results. The four trays are contained in wooden carrying case, size: 21½″ × 6⅛″ × 2⅝″; tray size: 20″ × 1¾″ × 1¼″, each; color reference size is 7/16″ diameter. Furnished with instruction manual and pad of 100 score sheets ..... *Complete* 14–1

Replacement Parts for 100 Hue Test

Color Disk in Cap (Specify by disk number 1–85) .... *One F–M Disk in Cap* 14–2

Complete set, 85 plus 8 pilot caps 14–3

Manual ..... *Each* 14–4

Score Sheet Form ..... *Pad of 100 Forms* 14–5

BURNHAM–CLARK–MUNSELL COLOR MEMORY TEST for detection of hue memory. Employs color caps from F–M 100 Hue Test. A color from one series of this collection is presented through aperture in housing, viewed by testee, then shuttered from view. After five second interval, testee must select match to test color from another series of colors presented through a second aperture. The second series contains all of the colors in the "test color" series plus additional colors of smaller intervals. The testee's selection is recorded on a score sheet; scores are computed as described in the Manual provided. Housing is 15¼″ × 15″ × 1½″. Color size is same as in F–M Test, 7/16″ diam. Furnished with instructions and pad of 100 score sheets. Produced to order only. Delivery approximately 90 days, F.O.B. Baltimore .... *Complete* 14–6

Manual ..... *Each* 14–7

Score Sheet Form ..... *Pad of 100 Forms* 14–8

SLOAN ACHROMATOPSIA TEST for screening the congenital achromat. Consists of 7 neutral gray scales each displaying 17 steps between black and white, with ¼″ apertures in center of each gray reference standard. Behind the apertures in six scales is permanently mounted one of 6 color references of strong chroma for: red, orange, yellow, green, blue and magenta. A color reference for middle gray is permanently mounted behind the apertures in the seventh scale. The testee selects the gray on the scale which appears to him to match the color reference mounted behind it. The Munsell notation of the gray match indicated by the testee is recorded; analysis of testee's record is described in instructions provided with test. Scales are 4″ × 11″. Gray reference standards are ½″ × 1½″. Produced to order only. Delivery approximately two weeks ..... *Set of 7 Sloan Test Scales* 14–9

Catalog Reference

CUSTOM COLOR STANDARDS are produced to order to match a submitted sample or color specification. For highest accuracy in matching color and finish, both sample and specification should be submitted with order. Fees quoted on request for special sizes, shapes and substrates. Please specify gloss if different from sample. Sheets are 6″ × 10″.

MATTE OR HIGH-GLOSS ..... *Original Sheet* 15–1

Additional sheets, ordered with original ..... *Each* 15–2

SEMI-GLOSS ..... *Original Sheet* 15–3

Additional sheets, ordered with original ..... *Each* 15–4

COLOR TOLERANCE SETS are tools for visually evaluating color differences from a specific reference color. The ideal color is duplicated in our materials; tolerances for hue, value and chroma are cooperatively determined with the client, and custom colors representing these tolerances are produced. Color standards are then arranged, in visual order, on gray background chart with apertures between adjacent colors. Instructions for use are printed on charts. This approach to color quality control is especially suitable when a number of suppliers must color match products, or product parts, that will appear together in end use, and when instrumentation is not technically or economically feasible. Submit samples and full details for further information.

Fees 15–5

COLOR MEASUREMENT of the Munsell notation for a submitted sample may be determined by several methods, depending upon the accuracy required and the physical form of the sample. Samples judged unsuitable for making reasonably accurate measurements will be returned without charge.

SPECTROPHOTOMETRIC METHOD is suitable for flat, homogeneous samples with smooth surface. Submitted samples should be 1½″ diameter, minimum, preferably larger. Smaller samples can be measured with some reduction in accuracy. Munsell notation derived from measurement is checked visually by comparison to standards of known notation. Report includes Munsell renotation and CIE data for light source "C." Copy of curve provided on request.

Report on 1 to 10 samples, at least 1½″ diam. ..... *Per Sample* 15–6

Report on additional samples, submitted at same time ..... *Per Sample* 15–7

Fees for Reporting Data for CIE Light Source "A" and for measurements on samples smaller than 1½″ diam., quoted upon request with submitted samples.

DISK COLORIMETRY METHOD is suitable for some products that cannot be measured on a spectrophotometer. Fees quoted upon request with submitted samples. ..... *Fees, per sample* 15–8

ESTIMATE METHOD is suitable for samples falling within the gamut of available color standards. Fees depend upon quantity and type of sample. Definite quotation upon request with submitted samples. 15–9

CONSULTATION on color problems requiring extensive discussion and/or investigation in areas of standardization, specification and quality control. By appointment. Fees to be mutually agreed upon. 15–10

ORDERING INFORMATION

Use descriptive title of item.

Book of Color order should include reference to finish of color standards required, as: "Matte *Book of Color*"; "Glossy *Book of Color*."

Individual Chart order should include reference to color designation and title of collection from which it was selected, as: "2.5R chart from Glossy *Book of Color*"; "8.5/ chart from Matte *Book of Color*"; "Gley chart from *Soil Color Collection*"; "5 GY chart from *Plant Tissue Color Collection*."

Individual Color Standard order, for either rectangle or disk, should include complete Munsell notation, size and finish required.

TERMS

Shipment: Stock items within 5 days, unless otherwise stated in Price Schedule or on quotations and acknowledgments.

Delivery: F.O.B. Baltimore, Maryland.

Payment: NET 30 days. Please include payment with orders under $10.00.

Prices: Subject to change without notice.

THE FOLLOWING CONSIDERATIONS GOVERN ORDERS FOR SHIPMENT TO DESTINATIONS OUTSIDE U.S.A.

We reserve the right to request payment in advance, which may be made through our bankers: Maryland National Bank, Baltimore, Maryland 21203, U.S.A.

All payments must be in U.S. funds.

An export handling fee is charged on all shipments outside the United States. This fee, up to 5% of net with a $2.00 minimum, will be added to invoices. Further charges, at cost, will be made for required translations, customs and consular invoices, certificates of origin, commercial invoices in excess of four copies, and other forms of extra documentation. Advance notice of charges will be given on request.

MUNSELL COLOR COMPANY, INC.
2441 N. Calvert Street
Baltimore, Maryland 21218
U.S.A.
Telephone: (Area 301) 243-2171

For the convenience of our foreign customers, we have appointed exclusive agents to serve the following countries. Orders and inquiries from these countries should be addressed directly to the named agent.

AUSTRALIA and NEW ZEALAND	Frank McCarthy Industrial Color & Design 38 Marshall Avenue Kew, Victoria 3101 Australia
FRANCE	Luneau & Coffignon 3 Rue D'Edimbourg Paris 8e, France
JAPAN	Kaigai Publications Limited Book Department Central P.O. Box 5020 Tokyo International Tokyo, 100–31 Japan
UNITED KINGDOM	The Tintometer Limited The Colour Laboratory Waterloo Road Salisbury, England

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